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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/329,156	06/09/1999	ZHIJUN QU	IR-1677	7761

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EXAMINER

HU, SHOUXIANG

ART UNIT	PAPER NUMBER
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2811

DATE MAILED: 12/20/2001

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/329,156

Applicant(s)

Qu et al.

Examiner

First Last

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1234



-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE three MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on Sep 24, 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-9 is/are pending in the application.
- 4a) Of the above, claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-9 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claims \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are objected to by the Examiner.
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. § 119

- 13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
- a) ☐ All b) ☐ Some\* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \*See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

## Attachment(s)

- 15) ☒ Notice of References Cited (PTO-892) 18) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 19) ☐ Notice of Informal Patent Application (PTO-152)
- 17) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). \_\_\_\_\_ 20) ☐ Other: \_\_\_\_\_

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## **DETAILED ACTION**

### ***Specification***

1. The disclosure is objected to because of the following informalities:

At page 5, line 18, the term of "Figure 4" should read as --Figure 5--.

Appropriate correction is required.

### ***Claim Objections***

2. Claim 1 is objected to because of the following informalities:

Claim 1 recites the limitation of "a plurality of diffusions of a conductivity type opposed to that of said second layer uniformly distributed into the surface of said second layer." However, it is not clear whether it means that the diffusions are uniformly distributed within each of the individual diffusion regions or that the diffusion regions are uniformly distributed with respect to each other. And, it is noted that the doping concentration is normally nonuniform within a region formed through diffusion.

Claims 5-8 are objected to as the recited limitation regarding the comparison between the total thickness of the first and second layers and the one in a design with a single layer of epitaxial silicon renders the claims indefinite, because the thickness of the epitaxial layer in the device design with a single epitaxial silicon can vary and be

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determined by various factors that are undefined here, such as specific doping concentrations, design safety margins, among others.

Appropriate correction is required.

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-9, insofar as the claim objections set forth above in the Office action being overcome, are rejected under 35 U.S.C. 103(a) as being unpatentable over Akiyama et al. ("Akiyama"; EP 0118921 A2).

Akiyama discloses a semiconductor device (Figs. 2-4, a vertical power MOSFET), comprising: a silicon substrate (1); a first layer (12; n<sup>-</sup>); a second layer (13; n); and, a plurality of p-type diffusions (3) distributed uniformly with respect to each other into the surface of the second layer, defining p-n junctions therein, and being separated by invertible channels in the second layer, wherein the resistivity in the second layer is lower than that of the first one, as the impurity concentration in the

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second layer is higher than the one in the first layer, and the thickness of the first layer is greater than that of the second one (see page 5, lines 3-13).

Although Akiyama does not expressly disclose that the doping impurities are uniformly distributed within each of the first and second layers, it is noted that the first and second layers in Akiyama are doped during epitaxial growth, and the only mentioned change of the flow rate of phosphene for the doping in Akiyama occurs between the ending of the first layer growth and the starting the second layer growth (see page 5, lines 7-9). And, one of ordinary skill in the art would readily recognize that each of the first layer and the second layer can be formed without having to introduce any additional change(s) in the flow rate of phosphene, for simplifying the process.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make the semiconductor device of Akiyama without introducing any additional change(s) in the flow rate of phosphene, so that the device would be formed with a simple process. And, without introducing any additional change(s) in the flow rate of phosphene, the epitaxially grown first and second layers would inherently have a first and second concentrations of doping impurities, inherently along with first resistivity and second resistivity, uniformly distributed in the first and the second layers, respectively.

Regarding claims 5-8, it is noted that it is well within the ordinary skill in the art make the semiconductor device of with the total thickness of the first and second layers

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being less than the one of a single layer of epitaxial silicon designed with various design factors (such as, among others, specific doping concentrations and design safety margins) being taken into consideration for a given blocking voltage, so that a device designed to block the given blocking voltage would be obtained with a minimum total thickness for the epitaxial layers (which reduces the epitaxial growth time, for the least).

### ***Response to Arguments***

5. Applicant's arguments with respect to claims 1-9 have been considered but are moot in view of the new ground(s) of rejection.

### ***Conclusion***

6. Papers related to this application may be submitted to Technology center (TC) 2800 by facsimile transmission. Papers should be faxed to TC 2800 via the TC 2800 Fax center located in Crystal Plaza 4, room 4-C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989). The Group 2811 Fax Center number is (703) 308-7722 or 308-7724. The Group 2811 Fax Center is to be used only for papers related to Group 2811 applications.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Shouxiang Hu** whose telephone number is **(703) 306-**

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**5729.** The examiner can normally be reached on Monday through Thursday from 7:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Tom Thomas**, can be reached on **(703) 308-2772**. The appropriate fax phone number for the organization where this application or proceeding is assigned is **(703) 308-7724**.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Technology Center Receptionists** whose telephone number is **(703) 308-0956**.



Shouxiang Hu

December 14, 2001